Debris Forecasting and Estimating

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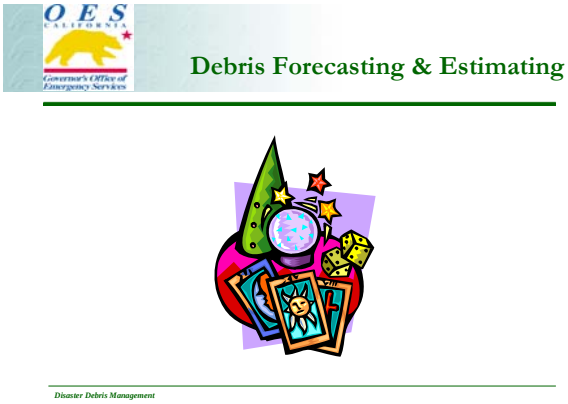
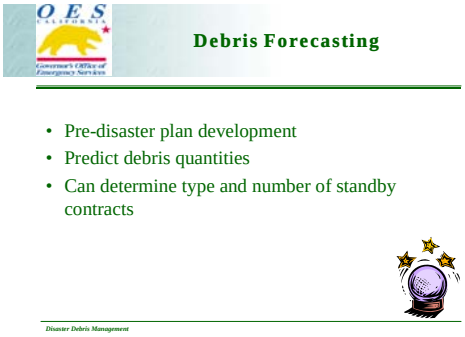
Introduction

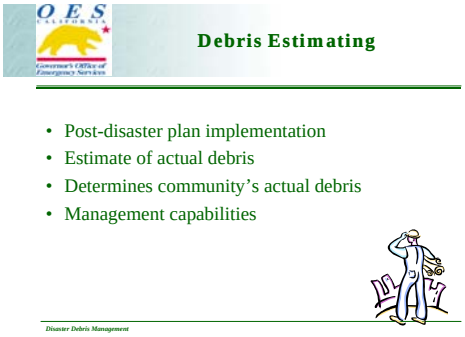


The purpose of this section is to present various debris forecasting and estimating techniques including various tools and rules of thumb to assist the Debris Manager in planning for large scale debris operations.

The determination of the quantity and type of debris is critical to debris management. Debris contracting, the management of Debris Management Sites and the possible need for State and Federal Resources (covered in following units) will require a reasonably accurate estimate of debris quantities.

Introduction – Cont'd





Debris forecasting is normally a pre-disaster technique used to predict debris quantities.

Certain planning assumptions must be made concerning the type and magnitude of debris generating events.

For instance, the plan would assume that a specific type of event, such as a major earthquake in a heavily populated area, would affect the area with large quantities of primarily construction and demolition debris.

Or, the plan may assume a range of debris generating events from small floods and tornados to catastrophic similar events.

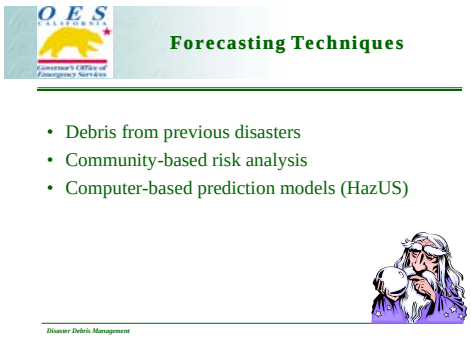
Debris Forecasting can also be used to determine the type and number of stand-by contracts required to remove and dispose of the predicted debris.

Debris estimating is normally used in a post-disaster situation to establish a reasonable estimate of the actual debris quantities and mix.

Debris estimates will be used to determine a community's actual capability to handle the situation.

Debris estimates will be used to determine the actual need for Debris Management Sites, contracts and landfill space requirements.

Debris Forecasting Techniques

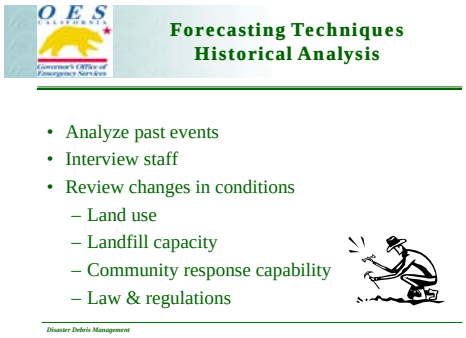


There are three basic techniques that are used for debris forecasting:

- An analysis of prior debris generating events can be conducted for your community or a similar community. With this analysis completed it may be possible to plan for effective response to similar type events. However, because the event may have been limited in scope or experienced debris staff is no longer available, this method has severe limitations.
- More commonly, a community-based risk analysis is completed to determine the types and quantities of debris generated by various events. This analysis is then used as a critical component of the debris management plan.
- Computers can be used for both of the first two techniques to perform calculations and present the analysis. However, there are a range of computer-based prediction models available to perform some of the more routine calculations, use a community's Geographical Information System (GIS) and plan for any number of event scenarios.

When these three techniques are combined a very effective analysis can be completed.

Debris Forecasting Techniques



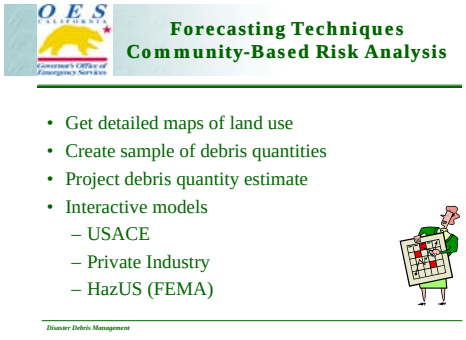
In order to complete an historical analysis of prior debris events, some basic information should be gathered:

- Prior event(s) should be selected from your community or from communities who have experienced the type of disaster you have forecasted for your community.
- Key staff members responsible for debris activities should be interviewed to determine procedures that were effective and those that were not.

An analysis of any effect in changes to the way your community would be able to respond to such events as:

- Land use changes that may increase or decrease the types of debris generated.
- A significant decrease in your landfill capacity or more current landfill regulations may have a very severe impact.
- An increase or decrease in your community's engineering or solid waste department staff could also make a difference in your response capability.

Debris Forecasting Techniques (Cont'd)



A simple method can be used to systematically forecast the type and quantity of debris for a community.

- First, obtain detailed maps of your community and highlight them with an indication of the type of land use in each area, such as urban, industrial, rural and mixed. This area separation will make your analysis as similar land use areas can be assumed to have similar debris types.

  - For instance: parks, orchards, groves, nurseries and tree-lined streets will have similar debris quantities based on an acreage or mileage basis.
  - Commercial and Industrial areas tend to have heavy amounts of construction and demolition type debris.
  - Residential areas can be a combination of vegetative and construction and demolition debris.
- Second, develop a representative sample of the debris in each area.
  - Debris quantities can be estimated using the guidelines provided:
    - One story house = Volume in cubic yards times 0.33
    - Personal property from flooded home without basement = 25-30 cy
    - Single wide mobile home = 290 cy
    - Double-wide mobile home = 415 cy

  - The terms light, medium and heavy are somewhat subjective, but the general guide is: If there is very light vegetation covering the house, yard or driveway, use the light column. If there is a canopy of trees covering the house, use the heavy column. Use the medium column for everything else.
- Third, project the sampling of debris for each area and provide a total of the amount and type of debris for each area. The grand total of all these calculations will provide you with an estimate useful for planning purposes.

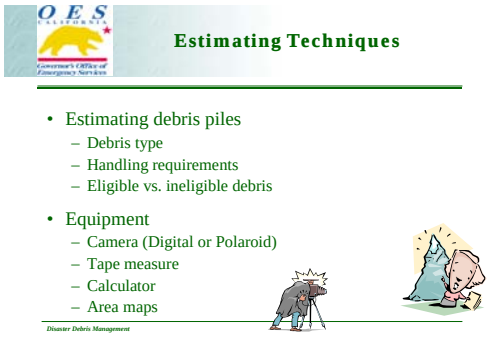
Please note that this type of debris forecasting is not an exact science. Broad assumptions and wide-scale projections must be made throughout the process. However, even with its inaccuracies, the resulting quantity estimate can be very useful in completing the next phases of the planning process, such as selecting Debris Management Sites or developing contracts.

Computerized modeling programs have been developed to provide reasonable debris predictions for communities under various disaster types.

Types of these interactive models are:

- USACE
- Private Industry
- HAZUS

Debris Estimating Techniques



There are many different ways to estimate debris. Being creative with the tools, techniques and information available to you can bring the best results. The following slides present various techniques and ways of using them alone and in combination with other techniques to provide the desired product.

Estimating Debris Piles

There are many things to consider when estimating debris:

- First consideration: type of debris, for example:
  - vegetative
  - construction and demolition
  - mobile homes
  - a mix of different things
- Identify handling requirements, for example, if you will need to separate it.
- For PA funding, determine if the debris is eligible or what portion is eligible.

It is important to have the correct tools, aids and information in place when doing estimates. Debris estimates are only as good as the basic information used to create them.

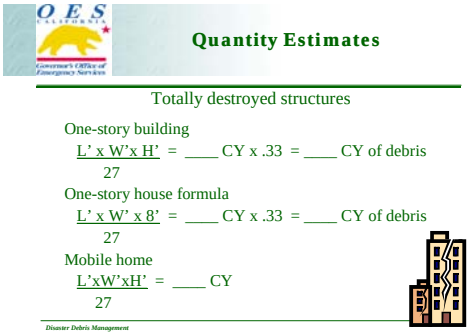
- Ensure that necessary equipment is available, including:
  - Digital (preferred) or Polaroid camera
  - 100-foot tape or roll-off wheel
  - Calculator, notepad, sketchpad
  - Maps of area
  - Aerial photographs (preferably before and after the disaster)
  - Dedicated vehicle and mobile communications

Once the equipment is in place, consider the area to be estimated and the manner in which the area should be divided (sectors). Debris estimating can be expedited by dividing the community into sectors based on any of the following:

- Type of debris: woody, mixed or construction material
- Location of debris: residential, commercial, or industrial
- Land use: rural or urban

Remember that however you define your area, you must be consistent with your system and keep detailed notes on how, where and what method you used for your estimates. These notes must be well documented and maintained for future reference. For Presidentially declared disasters, the information will be incorporated on the Project Worksheet.

Debris Estimating Techniques (Cont'd)



Estimating Aids – Buildings: The following information will assist you in determining the amount of debris from destroyed buildings, homes and debris piles:

- One-story building formula:
  L'xW'xH' = ___ CY x .33 = ___ CY
  27
- One-story house formula:
  L'xW'x8' = ____ cubic yards x 0.33 = ____ cubic yards of debris
  27' per cy
  (The 0.33 factor accounts for the "air space" in the house)
- Outbuildings
  L'xW'xH'x.033 = ____ cubic yards of debris
  27'
- Mobile homes formula:
  L'xW'xH' = CY
  27

Length =L, Width = W, and Height = H. All measurements are in "feet".

Note: The 0.33 factor is not applied to mobile home calculations due to their compact construction. The 27 factor is the conversion factor from cubic feet to cubic yards.

Typical quantities for mobile homes:

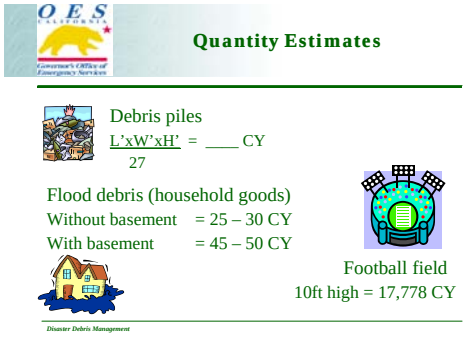
- Single wide mobile home = 290 cy of debris
- Double wide mobile home = 415 cy of debris

Participants typically have a difficult time accepting these numbers because they are larger than the standard stick-built homes. This has to do with the wasted air space in the average stick-built home. In

mobile homes there is very little wasted air space – every inch of the unit is used in storage, the walls are narrower, etc.

These numbers were verified during Hurricane Floyd. The State of North Carolina demolished approximately 2,000 mobile homes following that flood.

Quantity Estimates – Cont'd



Debris piles:

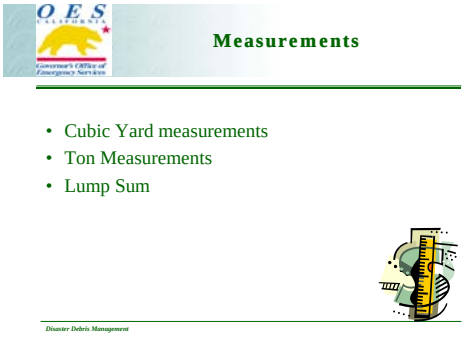
$$\frac{L'xW'xH'}{27} = \_\_\_ \text{ CY}$$

Length =L, Width = W, and Height = H. All measurements are in "feet".

Reminders: The following reminders may be of assistance when performing debris estimates:

- Look beyond the curb into side and backyards and at condition of the homes. Most debris in these areas will eventually move to the curb
- Wet storms will produce more personal property debris (household furnishings, clothing, rugs, etc.) if roofs are blown away
- Look for hanging debris such as broken limbs after an ice storm
- Flood-deposited sediment may be compacted in place. Volume may increase as debris is picked up and moved.
- Using aerial photographs in combination with ground measurements will help determine if there are any voids in the middle of large debris piles
- Treat debris pile as a cube, not a cone, when performing estimates

Measurements



Measurements can be done in many ways. In most cases, measurements are made by volume (cubic yards). However, if material is being taken to a landfill, there may be access to a scale for weight measurements. For demolition, contractors may use a lump sum price.

Stress that it is very important to record the process and basis for the estimate on the PWs (for public assistance funding) and other reports.

Cubic Yard: Cubic Yard (cy) measurements are used to determine the unit price of debris (woody, mixed or construction & demolition) transported to a Debris Management Site or permanent landfill.

- All trucks being used to transport debris must be measured and the resulting quantity in cubic yards recorded on the side of the truck and recorded on all load tickets
- Trucks with less than full capacities will be adjusted down by visual inspection by the Field Debris Monitor who will verify the quantity and type of debris contained in the bed of the truck from an inspection tower
- Load tickets are often used to document measurements.

Ton Measurements: All trucks must have a certified tare weight (empty) established if payments are going to be made based on certified scale net weight receipts. Field Debris Monitors will be required to spot check trucks after dumping to see if they are still at their tare weight.

- Note: Gross weight – tare weight = net weight.

Conversions

The following are rules of thumb. It will be necessary to do a field test to verify the makeup of the debris for your area and disaster type.

- Actual numbers can be very different. Taking an average load, measuring the truck, then weighing it will help determine what to use for a specific situation.

- When developing cubic yard (cy) measurements, divide cubic feet by 27.

- When converting from cy to tons, remember to use the correct factor:

- Use 2 if converting for construction & demolition material
- Use 4 if converting for woody material

- Rules of thumb:
  - 15 trees 8 inches in diameter = 40 cy (average)
  - Root system (8'-10' diameter) = may require one flat bed trailer to move
  - To convert cy of C&D debris to tons, divide by 2
  - To convert tons of C&D debris to cy, multiply by 2

Debris Estimating Techniques -Cont'd

Aerial Photography Estimates

Disaster Debris Management

Damage estimates can be made from available aerial photographs. A local newspaper supplied the above photograph.

To estimate debris using a photograph such as this:
1. Select an object in the photograph for which the length can be reasonably estimated, such as the truck
2. Measure the truck in the foreground and estimate its length at 25 feet
3. Apply that length to the intact houses to estimate the approximate length and width of each house. Calculate the approximate square footage by multiplying the length times the width. If you have houses of differing sizes, measure several and then calculate an average square footage.

Note: After the Oklahoma City tornado, photos from a news report and aerial photographs were used to do debris estimation. It can be very accurate in the right situation.

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